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21. (Amended) A method of forming an actuator, such method comprising the steps of
forming a flex circuit having conductive traces arranged in a pattern
bonding an electro-active [ceramic sheet] element to the flex circuit such that the
electro-active element is in contact with at least some of said conductive traces, and
assembling the flex circuit and the electro-active [ceramic sheet] element together
so as to constitute a card such that the [sheet] electro-active element has a non-shear coupling
over a region to an outer face of the card and is electrically coupled over said region to an
electrode of said flex circuit.
23. (Amended) A method of forming an electro-active device, such method comprising the
[step] steps of:
preparing first and second flex circuits with first and second electrodes and a
recess therebetween, and
bonding at least one electro-active element in the recess in mechanical and
electrical contact with said flex circuits over its surface area to form a unitary electro-active
structure.
25. (Amended) The method of claim 21, wherein the step of bonding includes bonding
plural pairs of electro-active [ceramic sheets] elements in the card.
26. (Amended) The method of claim 21, wherein said flex circuit is pliable in a region away
from said electro-active [ceramic sheet] element.
30. (Amended) The method of claim 21, wherein the step of bonding hardens the flex circuit
and bonded electro-active [ceramic sheet] element into a card.
- 32. The actuator device of claim 56, wherein said electro-active ceramic element is bonded
to said polymer insulator with a material selected from the group consisting of a heat-curable
epoxy, a pressure-curable epoxy, and a low temperature adhesive.
33. The actuator device of claim 56, wherein said polymer insulator comprises a material
selected from the group consisting of a polyamide, a polyimide, and a polyester.
34. The actuator device of claim 56, further comprising at least one spacer coplanar with
said electro-active ceramic element, wherein the at least one spacer contacts the polymer
insulator.
35. The actuator device of claim 34, wherein said spacer comprises a frame.
36. The actuator device of claim 56, wherein said conductor comprises an electrode.
37. The actuator device of claim 56, wherein said electro-active ceramic element is bonded
to said polymer insulator with a material comprising a heat-curable epoxy, thereby providing
strength to said actuator device.

38. The actuator device of claim 56, wherein said electro-active element comprises a first electro-active element and a second electro-active element, each of said first and second electro-active elements having at least one metal-coated surface.
39. The actuator device of claim 38, wherein said metal-coated surface of said first electro-active element is in direct electrical contact with said metal-coated surface of said second electro-active element.
40. The actuator device of claim 56, wherein said electro-active element comprises a first electro-active element having a metal-coated surface, and a second electro-active element, and wherein said second electro-active element is in direct electrical contact with said metal-coated surface of said first electro-active element.
41. The actuator device of claim 40 further comprising at least one spacer substantially coplanar to the electro-active ceramic element, wherein the spacer contacts the polymer insulator.
42. The actuator device of claim 56, said device further comprising an enclosing layer encasing said electro-active ceramic element and said flex circuit, and wherein said actuator device forms a card.
43. The actuator device of claim 21, further having a metal layer comprising copper
44. The actuator device of claim 56, wherein said actuator device has a curved shape.
45. The actuator device of claim 37, wherein said heat-curable epoxy forms a bonding layer defining a plurality of voids.
46. The actuator device of claim 45, wherein said second conductor is in direct electrical contact with said electro-active element through said voids.
47. The actuator device of claim 56, wherein said actuator device is configured as a stack, a flexure, a shell, a plate, or a bender.
48. An actuator device comprising:
- an electro-active ceramic element including a first conductor;
 - a second conductor, and
 - a polymer insulator,
- wherein at least said second conductor is in direct electrical contact with said first conductor of said electro-active ceramic element, and
- wherein said electro-active ceramic element and said polymer insulator are bonded together such that in-plane strain in said electro-active element is shear coupled between said electro-active element and said insulator,
- further comprising at least one circuit element in electrical communication with the electro-active ceramic element.
49. The actuator device of claim 43, said electro-active element comprising a first electro-active element and a second electro-active element, and said metal layer having a first surface and a second surface,

wherein said first surface of said metal layer is in direct electrical contact with said first electro-active element, and

wherein said second surface of said metal layer is in direct electrical contact with said second electro-active element.

50. The actuator device of claim 56, wherein said second conductor is positioned between said electro-active ceramic element and said polymer insulator.

51. The actuator device of claim 56, wherein said second conductor is positioned such that a portion of said second conductor is in physical contact with said electro-active element.

52. The actuator device of claim 56 further comprising an electrical connector in direct electrical contact with said second conductor.

53. The actuator device of claim 56 wherein said second conductor is in direct electrical contact with said electro-active element at a plurality of points.

54. The actuator device of claim 56, wherein said actuator device is shear-coupled to an object.

55. A method for damping vibration of an object, said method comprising the steps of:

(a) bonding the actuator device of claim 56 to a surface of the object such that in-plane strain of the electro-active ceramic element mechanically acts on the object through said polymer insulator when an electrical signal is applied to said second conductor; and

(b) applying an electrical signal to said second conductor.

56. An actuator device comprising:

an electro-active ceramic element including a first conductor; and

a flex circuit comprising a polymer insulator and a second conductor,

wherein said electro-active ceramic element is bonded to said flex circuit such that in-plane strain in said electro-active ceramic element is shear coupled between said electro-active ceramic element and said flex circuit, and

wherein said second conductor is in direct electrical contact with said first conductor of said electro-active ceramic element.

57. An actuator device comprising:

an electro-active ceramic element;

a flex circuit comprising a polymer insulator, a first electrode and a second electrode;

and

a bonding layer adhering said electro-active ceramic element to said flex circuit such that in-plane strain in said electro-active ceramic element is shear coupled between said electro-active element and said flex circuit,

wherein each of said first and second electrodes is configured as a comb having a plurality of teeth, said first and second electrodes being interdigitated,

wherein said first and second electrodes are in direct electrical contact with said electro-active ceramic element, and

wherein said electro-active element having a first surface and a second surface, said first and second electrodes being in direct electrical contact with said first surface of said electro-active ceramic element, and

said flex circuit further comprising a third electrode and a forth electrode,

wherein both of said third and forth electrodes are configured as a comb having a plurality of teeth, said third and forth electrodes being interdigitated,

wherein said third and forth electrodes are in direct electrical contact with said second surface of said electro-active ceramic element, and

wherein said third and forth electrode are connected to said first and second electrode through equipotential lines extending through said electro-active ceramic element.

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